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REPORT ON
INVESTIGATION OF PCB MANUFACTURING FACILITY
MONSANTO INDUSTRIAL CHEMICALS COMPANY
W. G. KRUMMRICH PLANT
SAUGET, ILLINOIS 62201

JANUARY 27, 1976

PERFORMED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY
ILLINOIS DISTRICT OFFICE
1819 WEST PERSHING ROAD
CHICAGO, ILLINOIS 60609

AND

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
REGION IV (SW)
117 WEST MAIN STREET
COLLINSVILLE, ILLINOIS 62234

INVESTIGATION OF PCB MANUFACTURING FACILITY
ILLINOIS DISTRICT OFFICE, USEPA

I. Company Identification

Monsanto Industrial Chemicals Company
William G. Krummrich Plant
Sauget, Illinois 62201

Telephone: 618-271-5835

Receiving Waters: Mississippi River via the
Sauget, IL Wastewater Treatment Plant

Responsible Officials

R. W. Flint, Plant Manager
A. E. Leisy, General Manufacturing Superintendent
P. E. Heisler, Director of Environmental Control
W. B. Papageorge, Manager, Product Acceptability (St. Louis)

II. Date of Inspection and Sampling

January 27, 1976

III. Participants

Company

W. B. Papageorge, Manager, Product Acceptability (St. Louis)
R. W. Flint, Plant Manager (W. G. Krummrich Plant)
A. E. Leisy, General Manufacturing Superintendent
Paul E. Heisler, Director of Environmental Control
Clarence F. Buckley, Supervisory Engineer, Environmental Control
Robert L. Harness, Senior Engineer
Julio Munoz, Environmental Control Engineer II

Sauget Village Waste Treatment Association

James Dalton, Superintendent
Fred W. Albowitz, Supervisor, WWTP

Illinois Environmental Protection Agency (618-345-6220)

Lawrence Eastep, Environmental Protection Engineer

U. S. Environmental Protection Agency (312-353-5638)

R. Edwin Zylstra, Chemical Engineer, ASB, Region V
Charles J. Miller, Physical Scientist, ASB, Region V
John F. Connell, Sanitary Engineer, ASB, Region V
Kenneth Burch, Chemical Engineer, Solid Waste Branch, Region V
Joseph V. Slovick, Engineering Technician, Illinois District Office
Roscoe W. Libby, Supv. Physical Scientist, Illinois District Office(Author)

IV. Objective

To obtain information on PCBs being discharged from the Manufacturing and Incineration Facilities at the W. G. Krummrich Plant in Sauget, Illinois; and to and from the Sauget municipal wastewater treatment plant. To verify the existence of a certified SPCC plan.

V. Summary and Findings

The results of sampling for PCBs are as follows:

ILDO Sample Number	Location and Sample Description	Concentration PCB (µg/l)			
		Aroclor 1016	Aroclor 1248	Aroclor 1254	Aroclor 1260
C-76-					
0349	W.G.K. Plant Process Effluent 1/	36	κ0.1	16	κ0.1
0350	W.G.K. Plant Incinerator Effluent	4.2	κ0.1	κ0.1	κ0.1
0352	Sauget WWTP Influent	15	κ0.1	κ0.1	κ0.1
0353	Sauget WWTP Effluent	24	κ0.1	19	κ0.1
0354	Reagent Blanks	0.2	κ0.1	κ0.1	κ0.1

1/ W.G.K. - William G. Krummrich Plant

LOADINGS LBS/DAY PCB TYPE

ILDO Sample Number	Location and Sample Description	Flow MGD	Loadings Pounds/Day	
			Aroclor 1016	Aroclor 1254
C-76-				
0349	W.G.K. Plant Process Effluent 1/	0.105	0.0315	0.014
0350	W.G.K. Plant Incinerator Effluent	0.206	0.0072	--
0352	Sauget WWTP Influent	12	1.5	--
0353	Sauget WWTP Effluent	12	2.4	1.9

1/ W.G.K. - William G. Krummrich Plant

Monsanto in a news release dated January 26, 1976 (Appendix 5) announced to their United States capacitor and transformer industry customers that they were going to phase out PCBs. This announcement has no date and is dependent on finding an acceptable substitute material.

Measurable amounts in pounds/day are being discharged from the Sauget wastewater treatment plant to the Mississippi River. PCB can and should be eliminated from the WWTP effluent.

The plant has a properly certified SPCC plan.

VI. Description of the Industry

The only plant that manufactures PCBs in the United States is the William G. Krummrich plant of the Monsanto Industrial Chemicals Company at Sauget, Illinois. Commercial manufacture of the Aroclor brand of chlorinated biphenyls was started in 1929. The products vary from oily mobile liquids to white crystalline solids and hard noncrystalline resins. Many of the PCBs in the environment were manufactured for uses such as fire resistant heat-transfer and hydraulic fluids, lubricants for high temperature and pressure uses, sealant and expansion media, and for uses in elastomers, adhesives, paints, inks, laquers, varnish, pigments, waxes, and noncarbon carbon paper. These uses have been discontinued and the only purposes for which PCBs are presently sold are for use in electrical capacitors and transformers.

Monsanto manufactures four grades of polychlorinated biphenyls for use in electrical capacitors and transformers as shown in the table below:

Designation	Appearance	Predominant Compound	Percent Cl ₂	Specific Gravity	Distil. Range °C	Flash Point °C
1221	Clear mobile oil	Monochlorobiphenyl	20.5-21.5	1.18	275-320	141-150
1242	"	Trichlorobiphenyl	42	1.36	325-336	176-180
1016	"	Trichlorobiphenyl	42	1.36	323-356	168
1254	Light yellow viscous liquid	Pentachlorobiphenyl	54	1.54	365-390	None to B.P.

Manufacturing Processes

The manufacturing unit consists of 6 chlorinators, 3 cascade and 3 batch type. The units are charged with the proper type of biphenyl and a catalyst (ferric chloride). Anhydrous chlorine is introduced into the reaction vessel and the charge is recirculated with a pump. The temperature of the mixture is kept well above the melting point of mixture, but below 150°C to avoid sublimating the material and plugging the hydrogen chloride discharge line. The pressure is kept near atmospheric with the contact time of 12-36 hours depending on the type of Aroclor desired. The HCl is scrubbed with liquid Aroclor and the anhydrous gas is sent to another part of the Sauget complex for purification.

The process is controlled by hydrometer readings for the lower chlorine contents. The more viscous material having a higher melting point is measured at the hold point where the material crystallizes, or by the ball and ring softening point test.

The crude PCB material is held at an elevated temperature and airblown for several hours before being sent to the raw Aroclor storage tanks. A fraction of a percent of alkali (NaOH or lime) is mixed with the storage tank contents to neutralize any remaining HCl or FeCl_3 . The air from the blower tank is vented to the atmosphere after being scrubbed with water. The scrubbed air is passed through a demister before release to the atmosphere.

The raw material is vacuum distilled to remove color and any traces of catalyst or hydrogen chloride. The vacuum is obtained by steam ejectors with the condensed steam being discharged to the plant sump. The residue (montars) are drummed and sent to be incinerated. Complete distillation and mixing of the distillate is necessary to obtain a uniform material of the desired composition.

To increase the electrical resistivity a few tenths of 1 percent dehydrated fuller's earth is mixed with the material at an elevated temperature followed by filtration through paper.

Incinerator

To achieve efficient destruction of PCBs a suitable balance between dwell time and temperature in the incinerator plus availability of excess oxygen must be obtained. The hydrogen chloride formed by combustion must be removed by suitable scrubbing devices. Two thousand degrees Fahrenheit plus 3 percent excess oxygen in the stack gas with a dwell time of 2 seconds or a 1.5 second dwell time at $2,700^{\circ}\text{F}$ and 2 percent excess oxygen in the stack gas are required for efficient destruction of waste Aroclors.

The Monsanto Company employs a John Zink incinerator operating on 25 percent excess air (5 percent O_2) at temperatures in excess of $2,200^{\circ}\text{F}$.

The montars from the manufacturing process retorts, the bottoms from separator sumps, accumulation from drip pans, and waste Aroclors returned for destruction are pumped to the incinerator unit. Steam is fed to atomize the liquid waste stream before the fire pot. Combustion is obtained using natural gas and excess air. The combustion products are cooled by a quench pot followed by a venturi scrubber and a packed tower. The liquid wastes from the incinerator and the water phase from the sump are sent to the Sauget municipal wastewater treatment plant.

The incinerator is capable of handling 6,000,000 pounds per year. Drainage at the site is conveyed by trenches and piping to a 10,000 gallon underground basin. The water layer from this concrete sump is pumped continuously and combined with the scrubber, quench pot and packed tower effluents. The PCB fraction in the sump is periodically pumped to the waste storage tanks.

The combined scrubber flow and the water phase from the underground sump is metered and pH monitored before discharge to the sewer system.

VII. Description of the Survey

Sampling Locations

Process Effluent (C-76-0349)

This was a grab sample taken at the parshall flume before the effluent discharged to the plant sewer system at Building 246.

Incinerator and Water Phase from Concrete Sump (C-76-0350)

This was a grab sample obtained at the metering flume at the incinerator complex.

Sauget WWTP Influent (C-76-0352)

A grab sample obtained of the influent to the treatment plant.

Sauget WWTP Effluent (C-76-0353)

A grab sample was obtained from the final tank at the effluent weir.

Reagent Blank (C-76-0354)

The reagent blanks were made from water obtained at the Central Regional Laboratory.

General

Glass bottles were used for the collection of the PCB samples. All samples were handled using glass or stainless steel equipment. The stainless steel buckets and funnels were rinsed with reagent grade petroleum ether before use. Separate buckets and funnels were used for each sample.

The samples were split with the Illinois Environmental Protection Agency and Monsanto. Standard USEPA sampling, preservation and analytical techniques were used and chain of custody procedures were followed in the collection and transportation of the samples.

A meeting was held with Monsanto and IEPA personnel before the plant survey. This meeting coordinated the USEPA air, solid waste and water effluent efforts. Monsanto personnel were helpful and cooperative. The weather was moderate throughout the survey period with no rain. Flows were obtained by direct measurement at the process waste site and at the

incinerator. The 12 MGD flow at the Sauget WWTP is an estimate obtained from the WWTP personnel as the parshall flume at the plant influent was being bypassed during plant upgrading.

Air samples were taken by personnel of the Air Surveillance Branch and the Monsanto solid waste disposal site was inspected by Mr. Kenneth Burch from Region V Solid Wastes Branch. A copy of his checklist is attached as Appendix 6.

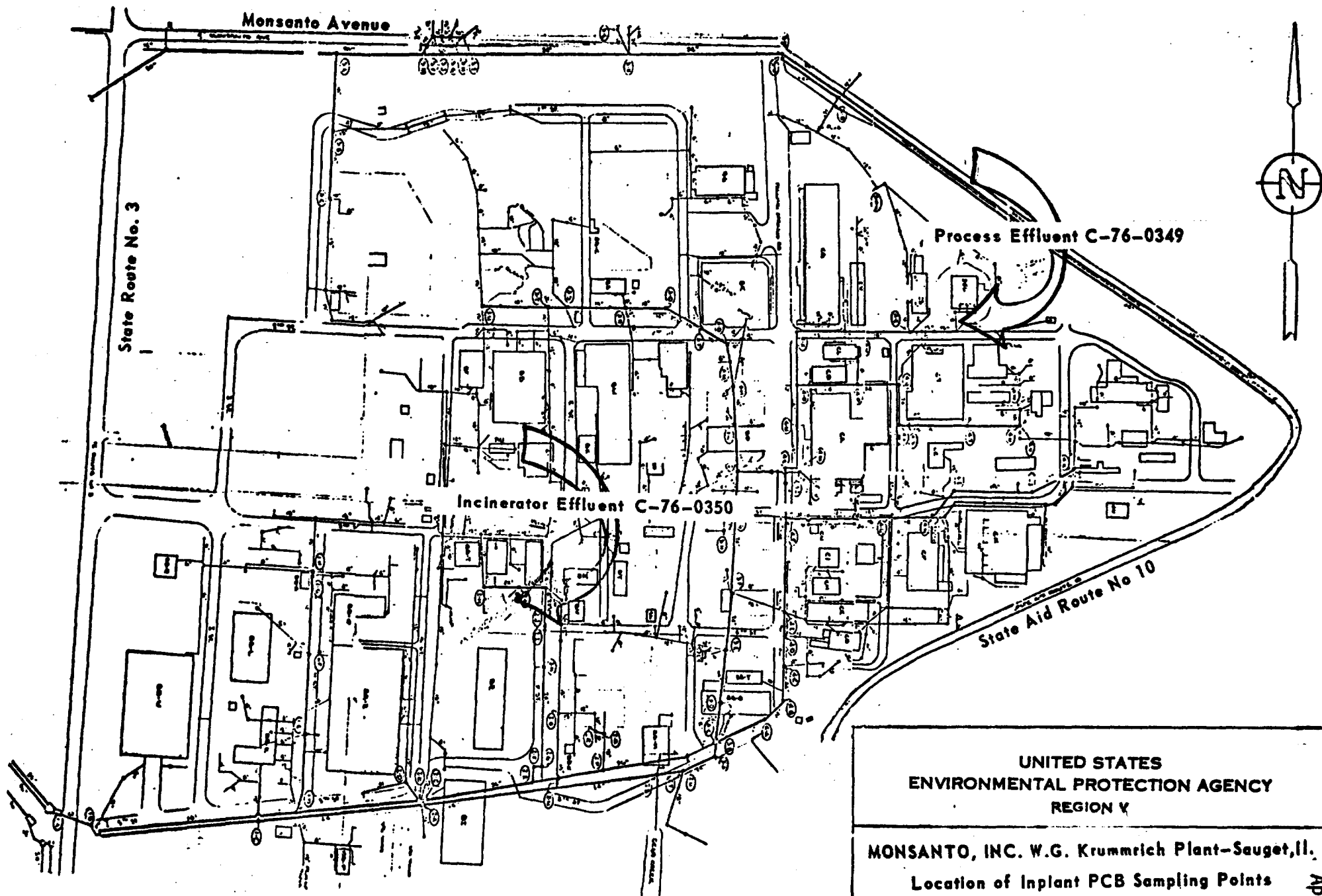
VIII. Recommendations

1. That alternate materials be found to replace PCBs in capacitors and transformers.

2. That zero discharge from the Sauget treatment plant to the Mississippi River be achieved. The substantially higher loadings from the Sauget WWTP may be due to a long existing accumulation in the plant sewer systems.

Appendixes

1. Location of Sampling Points
2. Flow Diagram - Incinerator
3. Flow Diagram for Process Manufacturing and Wastes
4. Location Map - W.G. Krummrich Plant
5. News Release dated Jan. 26, 1976
6. Checklist Prepared by K. Burch

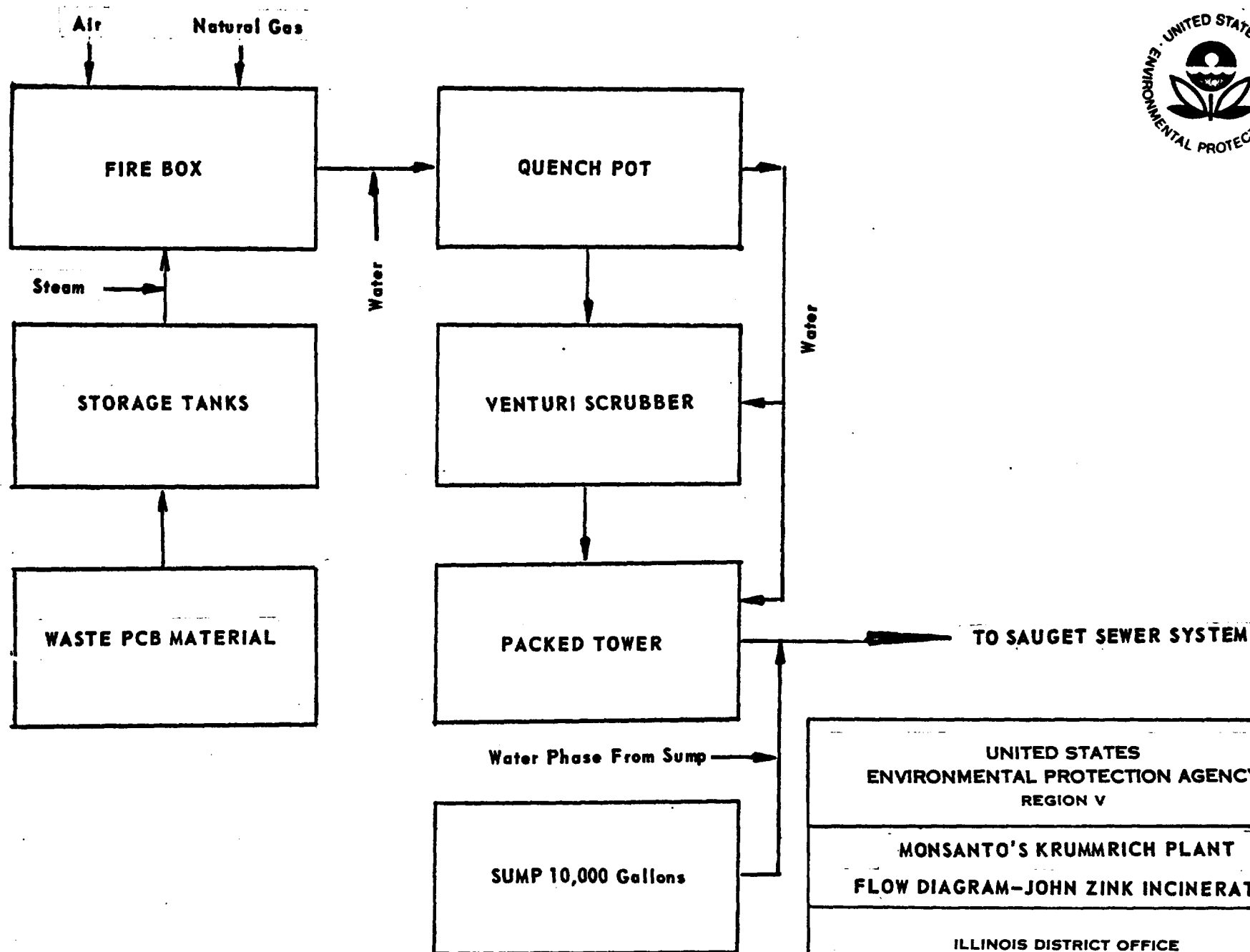


UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V

MONSANTO, INC. W.G. Krummrich Plant-Sauget, IL.
Location of Inplant PCB Sampling Points

ILLINOIS DISTRICT OFFICE
1819 W. PERSHING RD.
CHICAGO, ILLINOIS 60609

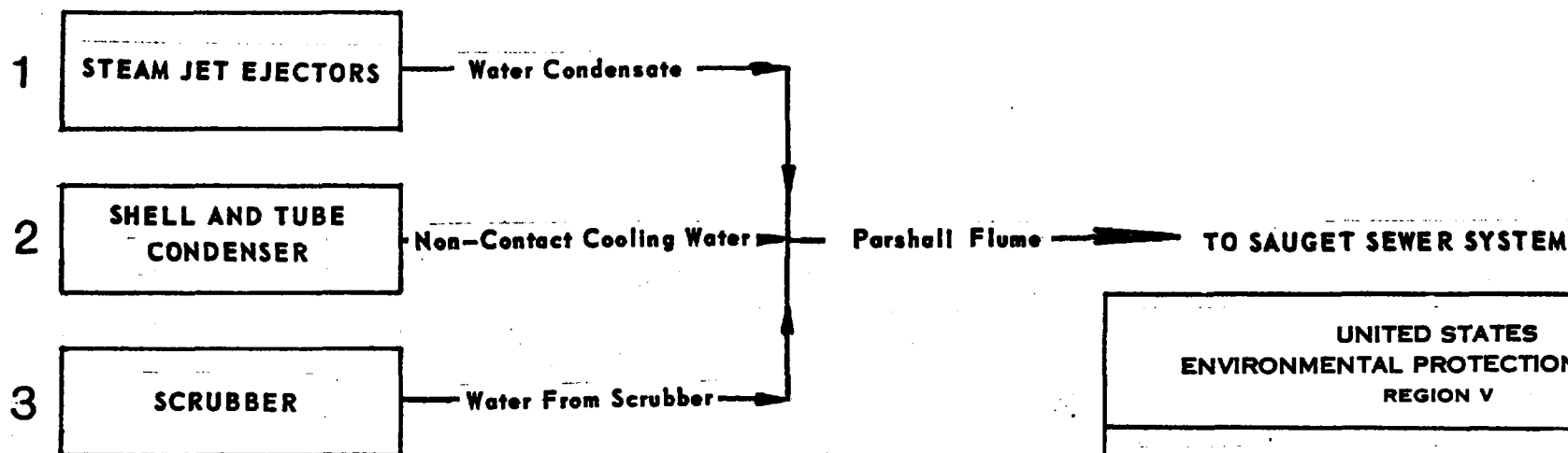
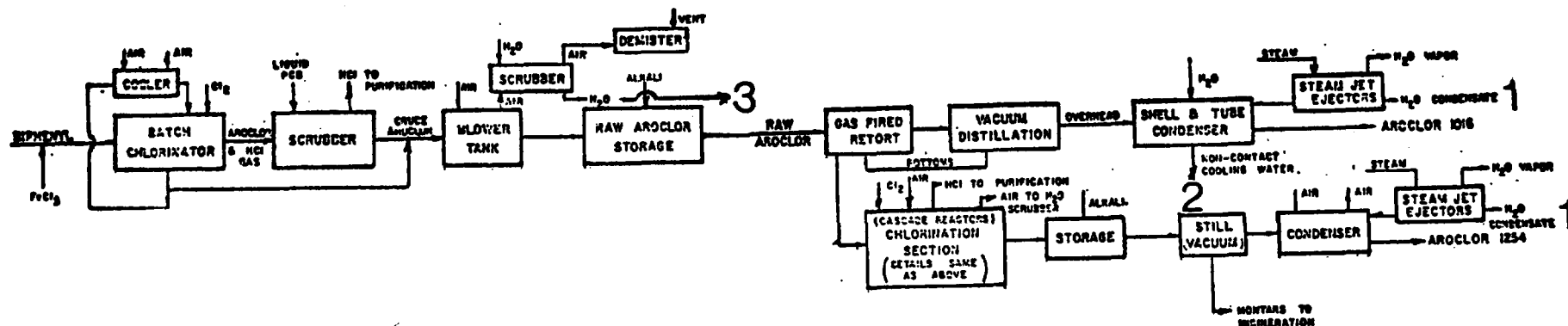
Appendix 1



UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V

MONSANTO'S KRUMMRICH PLANT
FLOW DIAGRAM-JOHN ZINK INCINERATOR

ILLINOIS DISTRICT OFFICE
1819 W. PERSHING RD.
CHICAGO, ILLINOIS 60609



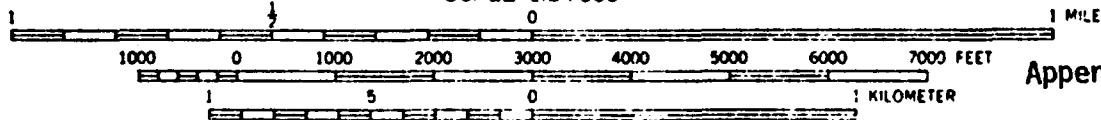
PCB PROCESS PLANT WASTEWATER DISCHARGES

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V

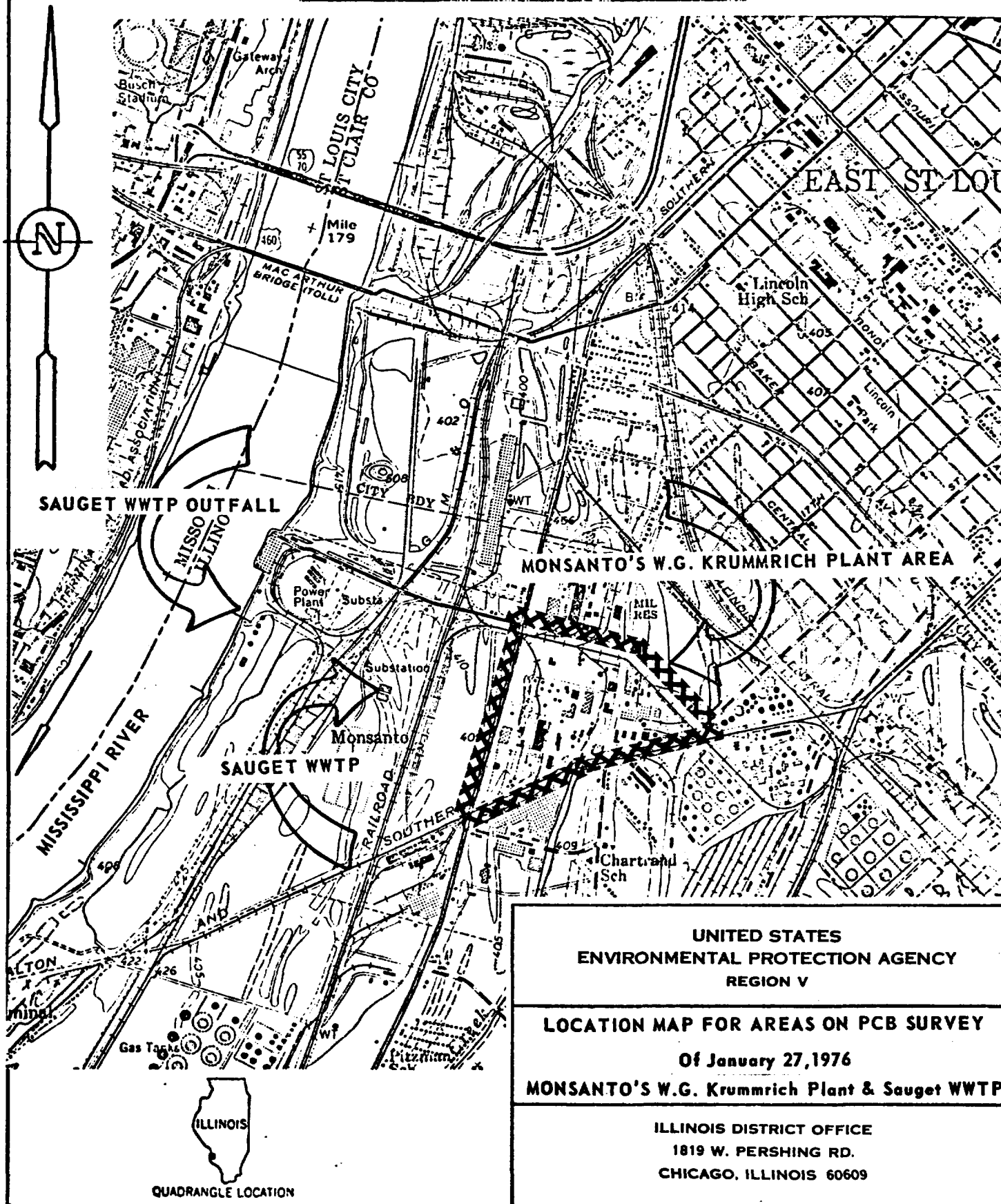
MONSANTO'S KRUMMRICH PLANT-SAUGET, IL.
PCB Manufacture Process Flow & Water Discharges

ILLINOIS DISTRICT OFFICE
1819 W. PERSHING RD.
CHICAGO, ILLINOIS 60609

SCALE 1:24 000



Appendix 4



UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V

LOCATION MAP FOR AREAS ON PCB SURVEY

Of January 27, 1976

MONSANTO'S W.G. Krummrich Plant & Sauget WWTP

ILLINOIS DISTRICT OFFICE
1819 W. PERSHING RD.
CHICAGO, ILLINOIS 60609

NEWS

Monsanto

FOR RELEASE
IMMEDIATELY 1976

MONSANTO INDUSTRIAL CHEMICALS CO.

Dan R. Bishop
(314) 694-2891

PUBLIC RELATIONS DEPARTMENT
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166

MONSANTO TO PHASE OUT PRODUCTION OF PCBs; DEVELOPING ALTERNATES

ST. LOUIS, January 26, 1976 -- Monsanto Company today announced that it has informed its U.S. capacitor and transformer industry customers and the U.S. Environmental Protection Agency that it intends to eventually phase out the production of polychlorinated biphenyl (PCB) dielectric insulating fluids. Dielectric fluids are non-conductors of direct electrical current and are necessary ingredients in most power generating equipment.

In making the announcement, F. J. Fitzgerald, a corporate vice president and managing director of Monsanto Industrial Chemicals Co., said it is too early to put an exact timetable on the phase out but that it would be in a planned and orderly manner. Mr. Fitzgerald added, "As soon as we are satisfied that the electrical power supply industry's needs for usable, acceptable alternate dielectric fluids have been met, by whomever, Monsanto will voluntarily shut down its PCB manufacturing unit."

In describing Monsanto's actions to date, aimed at restricting the further entry of PCBs into the environment, Mr. Fitzgerald emphasized three significant steps that have already been taken.

"1. Monsanto began restricting the use of its PCBs solely to closed electrical systems, for which no viable alternates existed, back in 1970. It should be noted that this voluntary program, which was fully implemented prior to the completion of the study done on PCBs

-more-

Appendix 5

by a Federal Interdepartmental Task Force in 1972, reduced Monsanto's annual PCB production by over 50 per cent.

"2. In our manufacturing area, we instituted controls, unique in the industrial chemicals industry, to minimize losses to the environment. We also installed a special high-temperature incinerator which completely destroys waste PCB by burning at temperatures above 2,000 degrees F. This service and other technical assistance is available to our customers on a continuing basis.

"3. Monsanto has been working for a number of years on non-PCB replacement products. These materials, designed to replace PCB fluids in capacitors and transformers, are currently being evaluated by electrical manufacturers in the United States."

Mr. Fitzgerald added that while the PCB issue is a difficult one to handle, the difficulty does not now, nor will it in the future, stem from any lack of effort or cooperation on the part of Monsanto. "The problems that we face collectively are rooted in the unique fire resistant and dielectric characteristics of PCBs, and the irreplaceable role they have played in electrical and industrial applications for the past 45 years," he said.

"The challenge is to replace them in an orderly manner without creating another hazard of equal or potentially greater consequences, while at the same time avoiding serious power and transportation disruptions. This is our goal. In the interim, we will continue to work with industry and government to ensure that the restrictive measures and controls we implemented in the early 1970s remain in force and are diligently pursued."

mercato 1/2/76

messing

Bob Plummer / Landfill

Checklist
prepared by
K. Burch
USEPA-V

Jan. 22, 1976 Checklist

OFF SITE DISPOSAL CHECKLIST

1. A. Nuclear Engineering & hauls & disposer of some (small amount) of toxic materials. material is disposed of in Sheffield, Ill. or Texas Geology site. This is the exception rather than the rule.
- B. ~~Other materials other than asbestos are shipped to Hygon~~ & incinerated via SLAY TRANSPORTATION
2. Yes
3. Yes
4. N/A
5. Only dept. of transp. regulations
6. Invoice from disposal firm
7. Separate packaging in drums.
8. Yes when a contaminated solid is received from a customer. Liquids are incinerated on site.
9. No. Liquid PCB material burned on site. Special label used on contaminated solid material drums (Special Residue label)

11. Each bill of lading contains a new hazardous waste phone # to call in case of emergency besides other pertinent info.

Treatment Disposal Phase

1. Hazardous waste is incinerated
 movement has an on site landfill operated 5 days a week, day shift only, but is only for non hazardous waste as determined by Monitors & test reports.
 medical lab.

2. Incinerator permitted by the state air program
 on site landfill has not require a landfill permit
 per state law.
 Incinerator must meet following conditions: 107163121ARC
 1. 1st cell conditions on form # APC-161
 2. Type 5 waste must be stored 150 lbs/ton to be incinerated.

3. The waste handlers only need to transport PCE contaminated material under state (Alaska DGC) to their own site.
 a. Bill of lading
 4. No need of report.

5. John Smith signed waste incinerator manifest 1513/12-14

5 continued from (3)

no treatment prior to immersion, some blanking may be done to mix other matter in to prepare a more easily handle material

Condenser Temp 2150° F to 2400° F
 Sample Time 3 seconds
 Space air 35%

temperature, water feed rate, O₂, are continuously monitored

6. Liquid material is fed into the reactor

feed rate 150 lb/hr max

that take include 0% organic materials 12. noticeable
 substances such as Temp, reactor flow, solvent shut
 the unit down. The unit has shut down but no
 recording of P&ID keeping in mind.
 These envelopes are now quarterly

7.

Quench column, venturi scrubber, packed scrubber,
 scrubber.
 Quarterly test on the system as a whole, not on individual

scrubber meter to convert to design to scrubber plant.

8.

In #3 a continuous sampling of scrubber meter
 is tested daily

9.

yes, scrubber meter shut with down in malfunction
 will shut down

10. no oil from the vent

11. no PCB contamination in the oil
only aside to fill. one part of filler for three parts, another
in for three parts.
Endowment of power waste in to never material end
By the waste oil in a cell

monitoring will indicate 30-35 psi to groundwater from the pit
cell line is completed, no artificial line
log material in mostly available

12. In # 4

Another material distance with it normal long.

13. During manufacturing, the 21/4 hr life, transfer, the
PCB material pumped out a small or increased
PCB material pumped out a small or increased

14. Document present day by of mail & record
no liquid to an oil barrel

15. It monitoring with taking down by still on summer or
some found with increase. It also runs with especially
for summer
LFO run with a sample

15. fill in the part prior to 73 did dispose of PCB material
16. not at the fill
17. site is fenced with a guard. close to a phone & first aid station.
- 18.
19. yes, but memo wants her to own fire dept. & sell these fire chief & some personnel. for

20.

21.

RECEIVED

MAR 5 - 1976

OFFICE OF DIRECTOR
S & A Division, EPA, Region V